Wiki orifice compressible flow

meter coefficient C which is defined as $C = \dfrac{C_d}{\sqrt{1 - \beta^4}}$ t

$$Q = C\,A_2\,\sqrt{2\,(P_1 - P_2)/\rho}$$

$$\dot{m} = \rho\,Q = C\,A_2\,\sqrt{2\,\rho\,(P_1 - P_2)}$$

Wiki orifice flow incompressible

(5) $\dot{m} = C\,A_2\,\sqrt{2\,\rho_1\,P_1\left(\dfrac{k}{k-1}\right)\left[(P_2/P_1)^{2/k} - (P_2/P_1)^{(k+1)/k}\right]}$

Formula part to simplify

$\left(\dfrac{k}{k-1}\right)\left[(P_2/P_1)^{2/k} - (P_2/P_1)^{(k+1)/k}\right]$

(6) $\dot{m} = C\,A_2\,P_1\,\sqrt{\dfrac{2\,M}{Z\,R\,T_1}\left(\dfrac{k}{k-1}\right)\left[(P_2/P_1)^{2/k} - (P_2/P_1)^{(k+1)/k}\right]}$

(8) $Q_1 = C\,A_2\,\sqrt{2\,\dfrac{Z\,R\,T_1}{M}\left(\dfrac{k}{k-1}\right)\left[(P_2/P_1)^{2/k} - (P_2/P_1)^{(k+1)/k}\right]}$

Utexas orifce flow compressible

$$w = C\,P_1\,A_2\,\sqrt{\dfrac{2g_c M}{RT_1}\left(\dfrac{\gamma}{\gamma-1}\right)\left[\left(\dfrac{P_2}{P_1}\right)^{2/\gamma} - \left(\dfrac{P_2}{P_1}\right)^{(\gamma+1)/\gamma}\right]}$$ (9)

AFT choked flow through orifice   What is value of R

$$\dot{m} = C_d A P_{down}\,\sqrt{\dfrac{2}{RT}\left(\dfrac{\gamma}{\gamma-1}\right)\left(\dfrac{P_{up}}{P_{down}}\right)^{\frac{\gamma-1}{\gamma}}\left(1 + \left(\dfrac{P_{down}}{P_{up}}\right)^{\frac{\gamma-1}{\gamma}}\right)}$$

Freestudy

$$m = C_d A_2\,\sqrt{\left[\dfrac{2\gamma}{\gamma-1}\right]\left\{[p_1\rho_1]\left[\left(\dfrac{p_2}{p_1}\right)^{\frac{2}{\gamma}} - \left(\dfrac{p_2}{p_1}\right)^{1+\frac{1}{\gamma}}\right]\right\}}$$

critical pressure ratio is :

$$r = \left(\dfrac{2}{\gamma+1}\right)^{\frac{\gamma}{\gamma-1}}$$